IN THE CLAIMS

Applicants hereby present the claims, their status in the application, and amendments thereto as indicated:

1. (Previously Presented) A proximity detection circuit comprising:

an asymmetric oscillator circuit having its on-period set by a resistor network comprising a plurality of fixed resistors and at least one variable resistor and having its off-period set by at least one fixed resistor and by at least one first single diode;

a first static protection circuit comprising a first plurality of diodes, one said diode adapted to conduct away from ground, another said diode adapted to conduct toward the supply voltage;

a reset path wherein a second single diode provides a discharge path for an antenna wherein said antenna is discharged to the same voltage for every time period;

the asymmetric oscillator being adapted to send an approximately uniform amount of charge during its on-period to said antenna;

the antenna voltage being decreased when the capacitance of the antenna is increased by a detected object;

a second static protection circuit comprising a second plurality of diodes, one said diode adapted to conduct away from ground, another said diode adapted to conduct toward the supply voltage;

an antenna impedance buffer comprising operational amplifier operated as a unity gain follower with the output terminal of said operational amplifier being fed back to the inverting input terminal;

a voltage peak detector comprising a third single diode, a current-limiting resistor, a peak storage capacitor and a bleed off resistor, said third single diode and said peak storage capacitor being adapted to capture the positive peak of exponential waveforms from the antenna impedance buffer, said current limiting resistor being adapted to

limiting current flow and to providing said antenna impedance buffer output with more phase margin to prevent oscillation, said bleed-off resistor adapted to providing a discharge pathway for said peak storage capacitor;

a low-pass filter adapted to filter out about 50 or about 60 Hz alternating current interference frequencies, said low-pass filter comprising an in-line resistor and a capacitor with one side tied to ground;

an amplifier with gain and voltage offset;

an auto-compensation capacitor adapted to filter out changes in DC voltage levels of signals while allowing transient signals to pass through;

a three-position switch adapted to provide three levels of detection sensitivity; and

an output comparator adapted to generate an output on signal when the signal voltage, applied to the inverting input terminal of said comparator, is less than the reference voltage, which is applied to the non-inverting input terminal of said comparator.

2. (Original) The circuit as in claim 1 wherein said detected object comprises a material with a dielectric constant at least equal to one-half the dielectric constant of water.

3. (Original) The circuit as in claim 1 wherein said transient signal is generated by a moving hand.

4. (Original) The circuit as in claim 1 further comprising:

a motor activation switch connected to receive an output of a flip-flop activated by said output signal of said output comparator.

5. (Previously Presented) A proximity detection circuit comprising:

an oscillator circuit comprising a first comparator adapted to provide an asymmetric signal as input to an antenna sensor;

an antenna sensor adapted to respond to a change in dielectric constant in said sensor's proximity;

a first operational amplifier adapted to buffer said antenna sensor to a peak detector wherein said antenna sensor has high impedance and said peak detector has low impedance;

a low pass filter adapted to filter out line noise frequencies in the 50 Hz and 60 Hz line ranges;

a second operational amplifier adapted to provide voltage offset to an input signal to said second operational amplifier and to amplify a signal from said peak detector as output from said second operational amplifier; and

a second comparator adapted to produce an output pulse wherein said output signal from said second operational amplifier is an input signal to said second comparator and is of sufficient duration, amplitude and speed of change to produce said output pulse.

6. (Canceled)

7. (Canceled)

8. (Previously Presented) A method for detecting small capacitance changes, utilizing a proximity detection circuit, comprising the steps of:

producing an asymmetric oscillator circuit having its on-period set by a resistor network comprising a plurality of fixed resistors and at least one variable resistor and having its off-period set by at least one fixed resistor and by at least one first single diode;

providing protection from static utilizing a first static protection circuit comprising a first plurality of diodes, one said diode adapted to conduct away from ground, another said diode adapted to conduct toward the supply voltage;

resetting an antenna sensor voltage to a fixed amount utilizing a reset path wherein a second single diode provides a discharge path for an antenna wherein said antenna is discharged to the same voltage for every time period;

charging up an antenna with an antenna voltage wherein an approximately uniform amount of charge is sent by the asymmetric oscillator during its on-period to said antenna;

having said voltage lower when the capacitance of the antenna is increased by a detected object with a relatively high dielectric constant;

protecting against static in the proximity detector by utilizing a second static protection circuit comprising a second plurality of diodes, one said diode adapted to conduct away from ground, another said diode adapted to conduct toward the supply voltage;

impedance buffering with an antenna impedance buffer wherein said buffer comprises a unity gain operational amplifier with the output terminal of said operational amplifier being fed back to the inverting input terminal;

detecting a peak voltage utilizing a detector which comprises a third single diode, a current-limiting resistor, a peak storage capacitor and a bleed off resistor;

capturing the positive peak of ~~the~~ exponential waveforms from the unity gain operational amplifier utilizing said third single diode and said peak storage capacitor to capture the positive peak of the exponential waveforms;

limiting current flow utilizing said current limiting resistor to limit current;

preventing oscillation by providing said antenna impedance buffer output with more phase margin, by utilizing resistance of said current limiting resistor;

providing a discharge pathway for said peak storage capacitor utilizing a bleed resistor;

filtering out about 50 Hz and about 60 Hz alternating current interference frequencies utilizing a low-pass filter, said low-pass filter comprising an in-line resistor and a capacitor with one side tied to ground;

providing voltage offset;

amplifying signal with an operational amplifier;

filtering out changes in DC voltage levels of signals while allowing transient signals, as generated by a waving hand, to pass through;

providing three levels of detection sensitivity utilizing a three-position switch;

generating an output on signal, utilizing an output comparator, when the signal voltage, applied to the inverting input terminal of said comparator, is less than the reference voltage, which said reference voltage is applied to the non-inverting input terminal of said comparator.

9. (Previously Presented) The method as in claim 8 further comprising the step of:

applying the output voltage at the output pin of the output comparator to ~~a~~ an edge triggered control logic circuit.

10. (Previously Presented) The method as in claim 9 further comprising the step of:

activating a motor switch when detecting a change in the output state of the output comparator.

11. (Canceled)

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. (Canceled)

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Canceled)

20. (Previously Presented) A proximity detection circuit comprising:

an antenna;

an asymmetric oscillator circuit electrically coupled to the antenna, the asymmetric oscillator circuit having an on-period set by a resistor network comprising a plurality of fixed resistors and by at least one variable resistor and having an off-period set by at least one fixed resistor and by at least one first diode, wherein the asymmetric oscillator circuit is adapted to send an approximately uniform charge to the antenna during the on-period;

a reset path electrically coupled to the antenna and the asymmetric oscillator circuit, the reset path comprising a second diode to discharge the antenna to a predetermined voltage every time period;

an antenna impedance buffer electrically coupled to the antenna, the antenna impedance buffer comprising an operational amplifier operated as a unity gain follower; and

an output comparator electrically coupled to the antenna impedance buffer, the output comparator receiving as input a signal from the antenna impedance buffer and a

reference voltage, the output comparator being adapted to generate output when the signal has a predetermined voltage level as compared to the reference voltage.

21. (Previously Presented) The proximity detection circuit of claim 20 further comprising at least one static protection circuit comprising at least one second diode adapted to conduct away from ground and at least one third diode adapted to conduct toward a supply voltage.

22. (Previously Presented) The proximity detection circuit of claim 20 further comprising a voltage peak detector electrically coupled between the antenna impedance buffer and the output comparator, the voltage peak detector comprising a fourth diode, a current-limiting resistor, a peak storage capacitor, and a bleed off resistor, the fourth diode and the peak storage capacitor being adapted to capture positive peaks of exponential waveforms from the antenna impedance buffer, the current limiting resistor being adapted to limit current flow from the antenna impedance buffer, and the bleed-off resistor being adapted to providing a discharge pathway for the peak storage capacitor.

23. (Previously Presented) The proximity detection circuit of claim 22, wherein the current limiting resistor is adapted to prevent oscillation at the antenna impedance buffer.

24. (Previously Presented) The proximity detection circuit of claim 22 further comprising a low-pass filter electrically coupled between the voltage peak detector and the output comparator, the low-pass filter being adapted to filter out about 50 or about 60 Hz alternating current interference frequencies.

25. (Previously Presented) The proximity detection circuit of claim 22 further comprising an amplifier electrically coupled between the voltage peak detector and the output comparator, the amplifier being adapted to provide gain and voltage offset.

26. (Previously Presented) The proximity detection circuit of claim 25 further comprising an auto-compensation capacitor electrically coupled between the amplifier and the output comparator, the auto-compensation capacitor being adapted to filter out changes in DC voltage levels in the signal while allowing passage of transient portions of the signal.

27. (Previously Presented) The proximity detection circuit of claim 25 further comprising a switch electrically coupled between the amplifier and the output comparator, the switch being adapted to provide the detection circuit with at least two levels of detection sensitivity.

28. (Currently Amended) A method for detecting small capacitance changes comprising:

producing an oscillating asymmetric signal having an on period and an off period;

charging an antenna with the oscillating asymmetric signal, wherein the oscillating asymmetric signal provides an approximately uniform amount of charge to the antenna during the on period;

discharging the antenna to a fixed voltage for every oscillation period;

buffering any impedance mismatch between the antenna and a peak detector utilizing an operational amplifier as a unity gain follower;

detecting a peak voltage in the antenna discharge with the peak detector;

generating an output pulse upon receipt of a signal from the peak detector when the signal is within predetermined duration, amplitude, and rate of change criteria.

29. (Currently Amended) ~~The method of claim 28 further~~ A method for detecting small capacitance changes comprising:

producing an oscillating asymmetric signal having an on period and an off period;

charging an antenna with the oscillating asymmetric signal, wherein the oscillating asymmetric signal provides an approximately uniform amount of charge to the antenna during the on period;

providing protection from static utilizing at least one static protection circuit comprising at least one first diode adapted to conduct away from ground and at least one second diode adapted to conduct toward the supply voltage;

discharging the antenna to a fixed voltage for every oscillation period;

buffering any impedance mismatch between the antenna and a peak detector;

detecting a peak voltage in the antenna discharge with the peak detector; and

generating an output pulse upon receipt of a signal from the peak detector when the signal is within predetermined duration, amplitude, and rate of change criteria.

30. (Canceled)

31. (Currently Amended) The method of claim [[30]]28, wherein detecting the peak voltage includes providing the peak detector with a diode and a peak storage capacitor, the diode and peak storage capacitor being adapted to capture peaks of exponential waveforms output from the operational amplifier.

32. (Currently Amended) The method of claim [[30]]28 further comprising preventing oscillation by including a current limiting resistor at the output terminal of the operational amplifier.

33. (Previously Presented) The method of claim 28, wherein after detecting the peak voltage the method further comprises filtering out about 50 Hz and about 60 Hz alternating current interference frequencies through a low-pass filter.

34. (Previously Presented) The method of claim 28, wherein after detecting the peak voltage the method further comprises offsetting and amplifying the signal from the peak detector.

35. (Previously Presented) The method of claim 28, wherein after detecting the peak voltage the method further comprises filtering out changes in DC voltage levels of the signal from the peak detector while allowing passage of transient portions of the signal.

36. (Previously Presented) The method of claim 28, wherein generating the output signal includes comparing the signal to a reference voltage to determine if the signal has a predetermined voltage level as compared to the reference voltage.

37. (Previously Presented) A proximity detection circuit comprising in electronic communication:

an asymmetric oscillator circuit having its on-period set by a resistor network comprising a plurality of fixed resistors and at least one variable resistor and having its off-period set by at least one fixed resistor and by at least one first single diode;

a first static protection circuit comprising a first plurality of diodes, one of said first plurality of diodes being adapted to conduct away from ground, another of said first plurality of diodes being adapted to conduct toward the supply voltage;

an antenna;

a reset path wherein a second single diode provides a discharge path for the antenna wherein said antenna is discharged to the same voltage for every time period;

the asymmetric oscillator being adapted to send an approximately uniform amount of charge during its on-period to said antenna, the antenna voltage being decreased when the capacitance of the antenna is increased by an object proximately disposed to the antenna;

a second static protection circuit comprising a second plurality of diodes, one of said second plurality of diodes being adapted to conduct away from ground, another of said second plurality of diodes being adapted to conduct toward the supply voltage;

an antenna impedance buffer comprising an operational amplifier operated as a unity gain follower with the output terminal of said operational amplifier being fed back to the inverting input terminal;

a voltage peak detector comprising a third single diode, a current-limiting resistor, a peak storage capacitor and a bleed off resistor, said third single diode and said peak storage capacitor being adapted to capture the positive peak of exponential waveforms from said antenna impedance buffer, said current limiting resistor being adapted to limit current flow and to prevent oscillation in said antenna impedance buffer output, said bleed-off resistor adapted to provide a discharge pathway for said peak storage capacitor;

a low-pass filter adapted to filter out about 50 or about 60 Hz alternating current interference frequencies, said low-pass filter comprising an in-line resistor and a capacitor with one side tied to ground;

an amplifier with gain and voltage offset adapted to amplify output from the low-pass filter;

an auto-compensation capacitor adapted to filter out DC voltage level changes in output from the amplifier; and

an output comparator adapted to generate an output on signal when output from the auto-compensation capacitor is applied to the inverting input terminal of said comparator and is less than a reference voltage applied to the non-inverting input terminal of said comparator.

38. (Previously Presented) The circuit as in claim 37 wherein said detected object comprises a material with a dielectric constant at least equal to one-half the dielectric constant of water.

39. (Previously Presented) The circuit as in claim 37 wherein said transient signal is generated by a moving hand.

40. (Previously Presented) The circuit as in claim 37 further comprising:

a motor activation switch connected to receive an output of a flip-flop activated by said output signal of said output comparator.

41. (Previously Presented) A method for detecting small capacitance changes comprising:

producing an asymmetric oscillator circuit having its on-period set by a resistor network comprising a plurality of fixed resistors and at least one variable resistor and having its off-period set by at least one fixed resistor and by at least one first single diode;

providing protection from static utilizing a first static protection circuit comprising a first plurality of diodes, one of said first plurality of diodes being adapted to conduct away from ground, another of said first plurality of diodes being adapted to conduct toward the supply voltage;

resetting an antenna sensor voltage to a fixed amount utilizing a reset path wherein a second single diode provides a discharge path for an antenna wherein said antenna is discharged to the same voltage for every time period;

charging an antenna with an antenna voltage wherein an approximately uniform amount of charge is sent by the asymmetric oscillator during its on-period to said antenna;

lowering said antenna voltage when the capacitance of the antenna is increased by a detected object with a relatively high dielectric constant;

protecting against static in the proximity detector by utilizing a second static protection circuit comprising a second plurality of diodes, one of said second plurality of diodes being adapted to conduct away from ground, another of said second plurality of diodes being adapted to conduct toward the supply voltage;

impedance buffering the antenna with at least a unity gain operational amplifier, the output terminal of said operational amplifier being fed back to the inverting input terminal;

detecting a peak voltage utilizing a detector which comprises a third single diode, a current-limiting resistor, a peak storage capacitor and a bleed off resistor;

capturing the positive peak of exponential waveforms from said unity gain operational amplifier utilizing said third single diode and said peak storage capacitor to capture the positive peak of the exponential waveforms;

limiting current flow from said unity gain operational amplifier utilizing said current limiting resistor to limit current;

preventing oscillation by providing said antenna impedance buffer output;

providing a discharge pathway for said peak storage capacitor utilizing a bleed resistor;

filtering out about 50 Hz and about 60 Hz alternating current interference frequencies utilizing a low-pass filter, said low-pass filter comprising an in-line resistor and a capacitor with one side tied to ground;

amplifying output from said unity gain operational amplifier;

filtering DC voltage level changes in output from said unity gain operational amplifier;

comparing output from said unity gain operational amplifier and a reference voltage with a comparator, said output being applied to the inverting input terminal of

said comparator and said reference voltage being applied to the non-inverting input terminal of said comparator; and

generating a signal with said comparator when output from said unity gain operational amplifier is less than said reference voltage.

42. (Previously Presented) The method as in claim 41 further comprising the step of:

applying the output voltage at the output pin of the output comparator to ~~a~~ an edge triggered control logic circuit.

43. (Previously Presented) The method as in claim 42 further comprising the step of:

activating a motor switch when detecting a change in the output state of the output comparator.